

# Hypovolemic Shock Management



COMBAT MEDIC ADVANCED SKILLS TRAINING (CMAST)

# Introduction

- One of the most critical skills for the soldier medic.
- Without proper airway management and ventilation techniques, casualties may die.
- Must be able to choose and effectively utilize the proper equipment for ventilation in a tactical environment.

# Fluid Resuscitation

- Control hemorrhage first.
- Casualties with significant injuries should have a single 18 ga IV with saline lock in a peripheral vein initiated.
- Casualties without significant injuries do not need an IV but should be encouraged to drink fluids.

# Saline Lock Kit



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# Saline Lock



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# Fluid Resuscitation

- If unable to start a peripheral IV consider initiating a sternal I/O.

F.A.S.T.1



# F.A.S.T.1



Click on picture for video

# Intraosseous Access

- Sternal vs. tibial.
- Majority of wounds are extremity wounds ( $> 60\%$ )
- Tibial cortex is very thick.
- Sternum protected by body armor.
- Sternum is uniform from person to person.



# Intraosseous Access

- Indications:
  - Inadequate peripheral access
  - Need for rapid access for medications, fluid or blood
  - Failed attempts at peripheral or central venous access

# Intraosseous Access

- Typical protocol precautions:
- F.A.S.T.1 not recommended if:
  - Casualty is of small stature:
    - Weight is less than 50 kg.
    - Pathological small size
  - Fractured manubrium/sternum - flail
  - Significant tissue damage at site
  - Severe osteoporosis
  - Previous sternotomy and/or scar

# Flow Capabilities

- 30 ml/min by gravity.
- 125 ml/min utilizing pressure infusion.
- 250 ml/min using syringe forced infusion.



# Administering Blood

- Blood is 4 times more viscous than NaCl.
- Result is 1/4 normal rate of flow when administering blood using gravity.
- Infusion catheter internal pressure during gravity infusion =  $\sim 75$  mmHg.
- Catheter can take up to 1,500 mmHg.
- Solution?
  - Use pressure infusion

F.A.S.T.1 is considered a short-term device and should not be left in place for  $> 24$  hours.

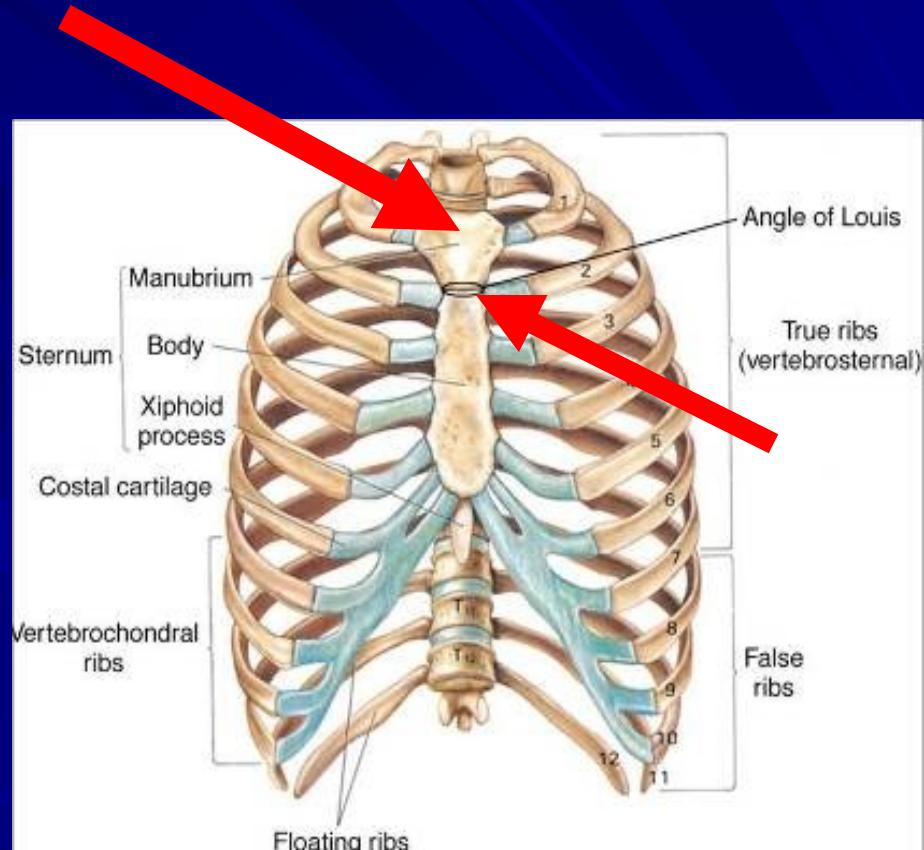


# Perpendicular Insertion

- F.A.S.T.1 must be inserted perpendicular to the surface of the manubrium.
- Device penetrates bone only 6 mm.
- Perpendicular relationship to the surface of the manubrium critical for catheter to enter marrow space.
- Rich vasculature drains manubrium...  
F.A.S.T.1 is equivalent to a peripheral IV.

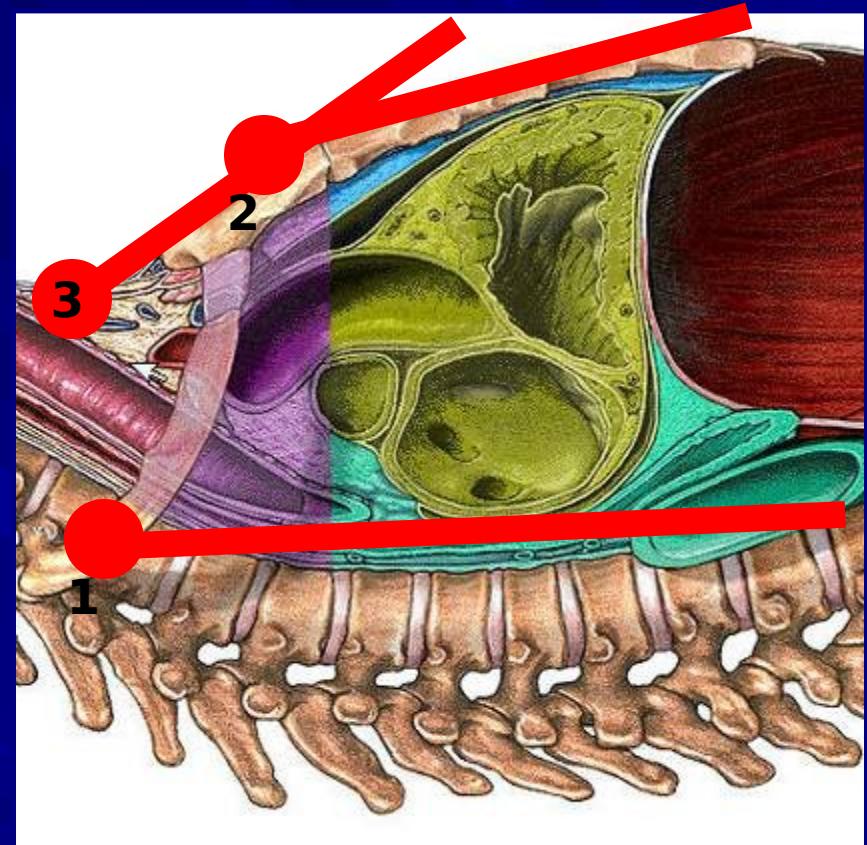
# Perpendicular Insertion

- Confirm landmarks:
  - Manubrium is upper aspect of sternal structure
  - Articulates with body of sternum at the “Angle of Louis”



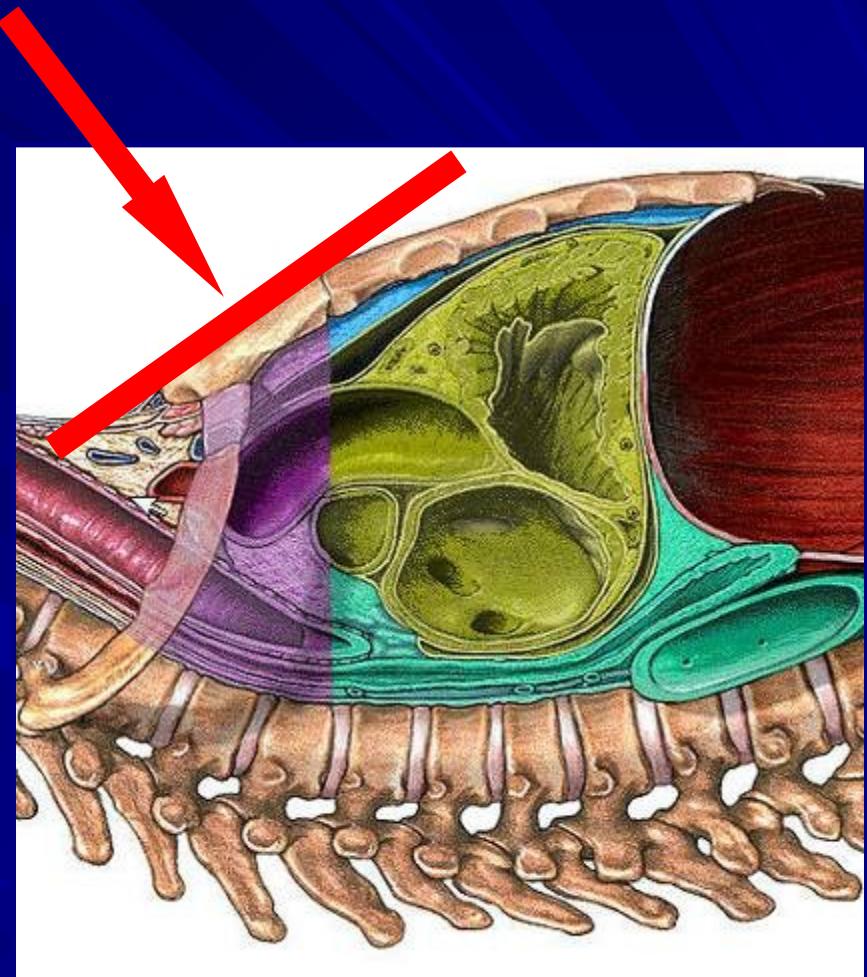
# Perpendicular Insertion

- Note that there are three planes relative to the casualty:
  - 1-Surface of ground
  - 2-Surface of body of the sternum
  - 3-Surface of the manubrium



# Perpendicular Insertion

- Manubrium surface angle is your point of focus.
- Perpendicular means at right angles to the surface of the manubrium.



# F.A.S.T.1 Procedure

- Procedure:
  - Prepare site using aseptic technique
    - Betadine
    - Alcohol



# F.A.S.T.1 Procedure

- Insertion:
  - Finger at suprasternal notch
  - Align finger with patch indentation
  - Emplace patch



# F.A.S.T.1 Procedure

- Insertion:
  - Place introducer needle cluster in target area
    - Assure firm grip
    - Introducer device must be perpendicular to the surface of manubrium



# F.A.S.T.1 Procedure

- **Insertion:**

- Insert using increasing pressure till device releases (~20-30 pounds)

**NOTE:** If more force than that is needed,  
it's not perpendicular)

- Maintain perpendicular alignment to the manubrium throughout



# F.A.S.T.1 Procedure

- **Insertion:**

- Following device release, infusion tube separates from introducer
  - Remove introducer by pulling straight back
  - Cap introducer using post-use cap supplied



# F.A.S.T.1 Procedure

- Insertion:
  - Connect infusion tube to tube on the target patch
  - Assure patency by use of syringe administer 5 ml blast of saline
    - Clears any tissue debris the infusion tube



# F.A.S.T.1 Procedure

- Insertion:
  - Connect IV line to target patch tube
  - Open IV and ensure good solution flow



# F.A.S.T.1 Procedure

- Insertion:
  - Emplace the dome over the site



# F.A.S.T.1 Procedure

- Insertion:
  - Be certain that remover device is attached to (and transported with) the casualty



# F.A.S.T.1 Procedure

- Problems areas:
  - Infiltration - usually due to insertion not being perpendicular to the manubrium
  - Inadequate flow or no flow -
    - Infusion tube occluded
    - 1 ml saline flush recommended
    - Infusion catheter inserted at other than a perpendicular angle to the manubrium surface

# F.A.S.T.1 Procedure

- Removal procedure:
  - Stabilize target patch with one hand
  - Remove dome with the other



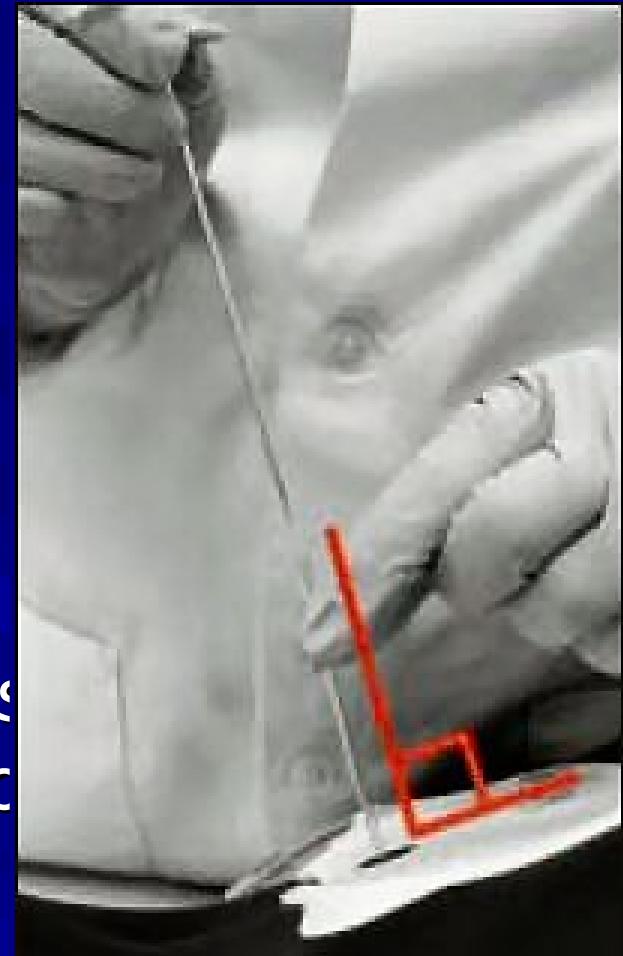
# F.A.S.T.1 Procedure

- Removal procedure:
  - Terminate IV fluid flow
  - Disconnect infusion tube



# F.A.S.T.1 Procedure

- Removal procedure:
  - Hold infusion tube perpendicular to the manubrium
  - Maintain slight traction on the infusion tube
  - Insert the remover while continuing to hold infusion tube in slight traction



# F.A.S.T.1 Procedure

- Removal procedure:
  - Advance remover
  - **THIS IS A THREADED DEVICE**
  - Gentle counterclockwise movement at first may help in seating remover
  - Make sure you feel the threads seat



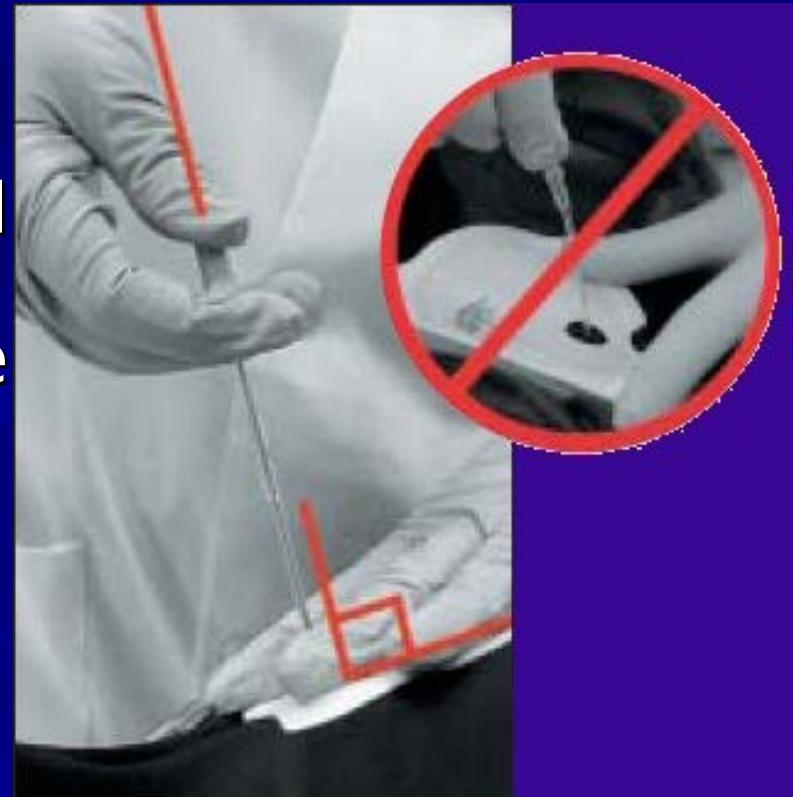
# F.A.S.T.1 Procedure

- Removal procedure:
  - Turn it clockwise until remover no longer turns
  - This firmly engages remover into metal (proximal) end of the infusion tube



# F.A.S.T.1 Procedure

- Removal procedure:
  - Remove infusion tube
  - Use only “T” shaped knob and pull perpendicular to the manubrium
  - Hold target patch during removal
  - DO NOT pull on the Luer fitting or the tube itself



# F.A.S.T.1 Procedure

- Removal procedure:
  - Remove target patch



# F.A.S.T.1 Procedure

- Removal procedure:
  - Dress infusion site using aseptic technique
  - Dispose of remover and infusion tube using contaminated sharps protocol



# F.A.S.T.1 Procedure

- Removal procedure:
  - Problems encountered during removal
    - Performed properly...should be none!
    - Be certain threads on remover engage threads at distal end of infusion catheter
    - Moving remover around with tip as axis while in the infusion catheter may shear off end of removal tool

# F.A.S.T.1 Procedure

- Removal procedure:
  - If removal fails or proximal metal ends separates:
    - Anesthetize with local - make small incision
    - Remove using clamp and close as appropriate

NOTE: This is “serious injury” as defined by the FDA and is a reportable event

# Intravenous Solutions

- Different types of IV fluids can be used for different medical conditions
- Generally categorized as:
  - Colloid or Crystalloid



# Colloids

- Contain protein, sugar or other high molecular weight molecules; used to expand intravascular volume.
  - Whole blood (most common)
  - Packed red blood cells
  - Fresh frozen plasma
  - Plasma Protein Fraction
  - Hypertonic Saline & Dextran (HSD)
  - Hextend is a 6% hetastarch solution in a balanced electrolyte solution



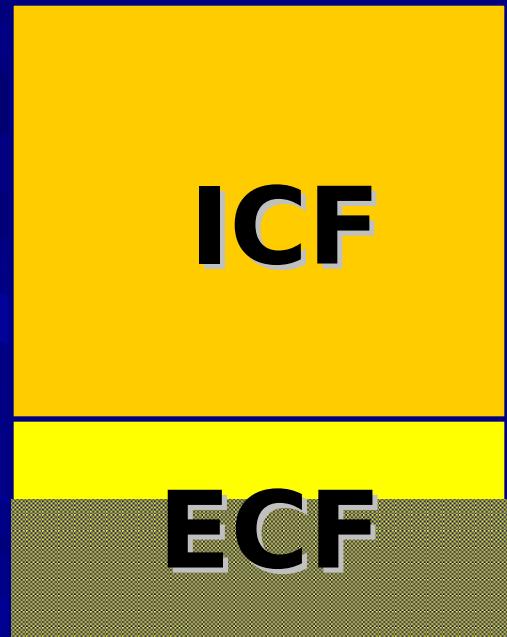
# Crystalloids

- Solutions that do not contain protein or other large molecules; sodium is the primary osmotic agent.
- These fluids do not remain in the vascular system very long.
  - Normal Saline (NS, 0.9% NaCl)
  - Lactated Ringers (LR)



# Fluids

- Fluid distribution.
  - Intracellular space = 2/3 of body weight.
  - Extracellular space = 1/3 of body weight.
    - Interstitial space 80%
    - Vascular space 20%



# Fluids

- 1,000 ml of Ringers Lactate (2.4 lbs) will expand the intravascular volume by 200-250 ml within 1 hour.
- Why only 200-250 ml left?
  - Sodium diffuses out of the blood vessels into the extravascular (interstitial) space rapidly.

# Hextend

- 500ml of Hextend® weighs 1.3lbs will expand the intravascular volume by 800ml within 1 hour, and will sustain this expansion for 8 hours.
- How does this happen?
- Large sugar molecule-pulls fluid from the extra vascular (interstitial) space into the vessels.

# Fluids

- One liter of Hextend = 6-8 liters of RL.
- Is it a better resuscitation fluid?
- No, it is better for hypovolemia because of its weight and cube advantage for the soldier medic.
- Ringers lactate is better for dehydration.
- Soldier medics must carry some of each.

# Resuscitation Indicators

- How do you determine who needs fluids?
- Blood Pressure.
- Peripheral (radial) pulse.
- Can BP be measured in a combat environment?
  - Helicopters
  - Tracks
  -



# Hypotensive Resuscitation

- Casualties should only be resuscitated to a blood pressure of 80 mmHg.
- If blood vessels have clotted can you raise the blood pressure high enough to pop the clot off?
  - YES at a BP of @ 93 mmHg

# Resuscitation Indicators

- The systolic blood pressure may be approximated by palpating specific pulses:
  - Palpable carotid pulse = 60 mmHg
  - Palpable femoral pulse = 70 mmHg
  - Palpable radial pulse = 80 mmHg

# Fluid Resuscitation

- Superficial wounds (>50% injured); no immediate IV fluids needed. Oral fluids should be encouraged.



# Fluid Resuscitation

- Any significant extremity or truncal wound (neck, chest, abdomen, pelvis).
- If the casualty is coherent and has a palpable radial pulse (BP 80 mmHg), initiate a saline lock, hold fluids and reevaluate as frequently as the situation permits.

# Fluid Resuscitation

- If casualty has a palpable radial pulse, why initiate a saline lock?
  - By establishing intravenous access now, when they have an adequate BP, it is easier than when they have a lower/absent BP.

# Fluid Resuscitation

- Significant blood loss from any wound, and the soldier has no radial pulse or is not coherent -**STOP THE BLEEDING**- by whatever means available - tourniquet, direct pressure, hemostatic dressings, or hemostatic powder etc.
- Start 500 ml of Hextend®. If mental status improves and radial pulse returns, maintain saline lock and hold fluids.

# Fluid Resuscitation

- If no response is seen give an additional 500 ml of Hextend® and monitor vital signs. If no response is seen after 1,000 ml of Hextend®, consider triaging supplies and attention to more salvageable casualties.
- Why?
  - Resources: How many more casualties do you have and how much fluid is available?

# Fluid Resuscitation

- If casualties are not resuscitated with 1,000ml of Hextend they are probably still bleeding. If excess fluids are given they will die faster than a casualty who received no fluids.
- Why? Increased BP and coagulation factors diluted as BP rises hemorrhage increases
- Why then does ATLS recommend 2 large-bore IVs and fluid run wide open? The transit time to definitive care is only a few minutes.

# Why does hypothermia happen?



# Hypothermia

- Casualties who are hypovolemic quickly become hypothermic.
- Body temperatures below 91° F causes the vicious triad.
  - Hypothermia
  - Acidosis
  - Coagulopathy

# Hypothermia

- When this vicious triad occurs the casualty's blood will not clot.
- Prevention is the best method.

# Field Expedient Warming

- Warm IV fluids in cold environment.



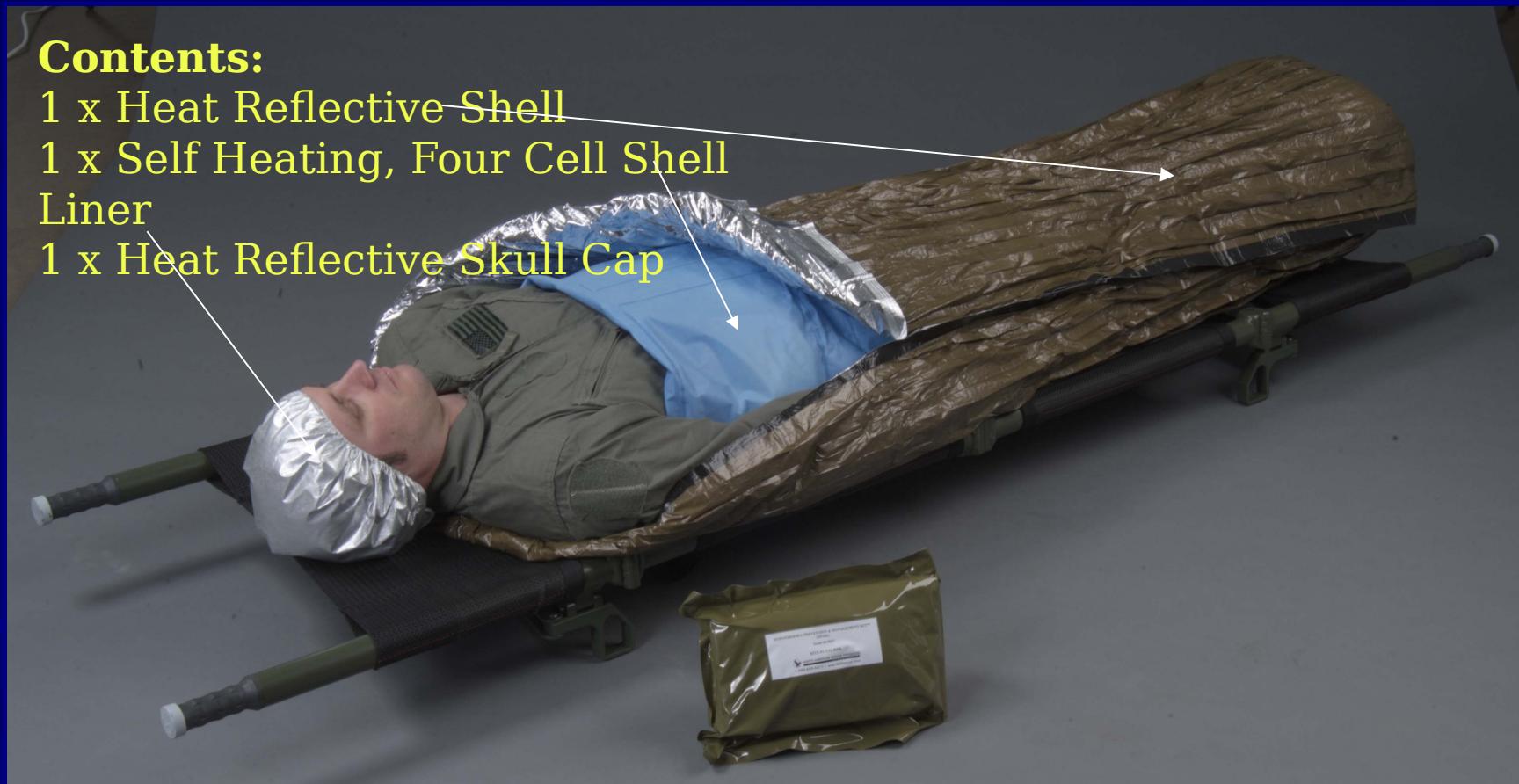
# Hypothermia

- Prior to evacuation, casualties must be wrapped in a blanket to prevent heat loss during transport (even if the temperature is 120° F) especially true with air evacuation

# Hypothermia Prevention and Management Kit™

## Contents:

- 1 x Heat Reflective Shell
- 1 x Self Heating, Four Cell Shell Liner
- 1 x Heat Reflective Skull Cap



# Hypothermia Prevention and Management Kit™ (HPMK) Ready for Transport



6 - Cell

“Ready-Heat”  
Blanket

4- Cell

“Ready-Heat”  
Blanket

Blizzard  
“Survival  
Wrap



**Ready-Heat™**

Heated medical disposable blanket

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# Summary

- Identify hypovolemic shock.
- Ensure hemorrhage control first.
- Provide treatment for hypovolemic shock using hypotensive resuscitation principles.

# Questions?

